Global Veterinaria 17 (1): 78-94, 2016
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2016.17.01.1046

# Availability, Yield and Utilization Practices of Livestock Feed Resources in Gilgel Gibe Catchments of Jimma Zone, Southwestern Ethiopia

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**Abstract:** The study was conducted in three selected districts of Jimma zone, Southwest Ethiopia with the aim of assessing livestock feed resources utilization systems in order to identifying the major constraints and opportunities of livestock production in relation to feed. The study districts were selected based on their livestock production potential and accessibility. Accordingly 122, 188 and 104 households (HHs) from Kersa, Omo Nada and Tiro Afeta districts, respectively were participated in the study. The respondents HHs were purposively selected depending on their livestock keeping experience and having a single species of livestock. The study revealed that crop residue, stubble grazing and natural pasture in a decreasing order were the main feed resources; however, they varied with seasons ($P<0.05$). Asteraceae, Fabaceae and Poaceae were the major fodder plant families. The main crop residues were teff straw, maize and sorghum stovers ($P<0.05$). The Mean annual total utilizable feed supply per HH was 4.53 tDM of which, 4.01 tDM (about 88.5%) was derived from cropping system which comprised of 3.04 tDM utilizable crop-residues and 0.97 tDM stubble grazing. Total utilizable DM production from cropping system per household was significantly varied ($P<0.05$) between the study districts. The annual maintenance DM requirement per HH for TLU was estimated to be 11.44 tDM. Hence, the existing feed supply can satisfy only 39.59% of the annual maintenance DM requirement of livestock units per HH ($P<0.05$), pointing to the need to discern adaptation of livestock to feed insufficiency athwart the year. The feed supply can no longer support the existing livestock in the study districts unless possible intervention is made by decision making bodies and channeled to the farming community through extension workers.

**Key words:** DM Requirement · DM Supply · Feed Resources · Feed Utilization · Tropical Livestock Unit

## INTRODUCTION

Livestock contributes 15 to17 percent of GDP and 35 to 49 percent of agricultural GDP and 37 to 87 percent of the household income in Ethiopia [1]. They provide inputs (Draught power, manure) to the other segment of the farming system such as crop production and generate consumables or saleable outputs as Milk, manure, meat, hides and skin, wool, hair and eggs [2].

Livestock feed resources are classified as natural pasture, crop residue, improved pasture and forages, agro-industrial by-products, other by-products like food and vegetable refusal, of which the first two contribute the largest feed type [3,4]. In the highlands, crop residues and agro-industrial by-products augment natural pasture and in the pastoral system, livestock production is almost totally dependent on native pasture and woody plants [5, 6]. According to Yisehak *et al*. [7] the major feed

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resources bases of three districts in Jimma zone of Southwest Ethiopia are natural pasture (Mainly communal), after math grazing, crop residues, green fodder and non-conventional feeds like *attela* (Local alcohols leftover), house leftover, grain mill byproducts, *chat* (*Catha edulis*) left over, coffee pulp and husk. According to same authors continues grazing on natural pasture is the livestock feeding system practiced in the study area. However, the natural grazing lands in the mixed crop livestock systems of the highlands of Ethiopia are seriously overloaded with stocks generally beyond their optimum carrying capacity causing overgrazing, erosion and overall land degradation [8, 9].

For optimum livestock productivity, the available feed resource should match with the production systems practiced and the number of animals in a given area. On the other hand the availability and relative importance of different feed resources varies from place to place and from time to time depending up on agro-ecology, livestock production systems and seasons of the year. Therefore assessment of available feed resources in relation to season, the livestock production systems practiced and requirements of livestock on annual basis in a given area is important to diagnose the problems and suggest intervention measures to be taken by farmers and policy makers. However, there was scanty of information regarding the assessment of livestock feed resources and utilization in crop-livestock mixed farming systems of three districts of Jimma zone, Southwest Ethiopia. Therefore this study aimed to assess livestock feed resources and its utilization in three selected districts of Jimma zone, Southwest Ethiopia.

## MATERIALS AND METHODS

**Description of the Study Area:** The cross-sectional field survey was conducted in three districts of Jimma zone (Kersa, Omo Nada and Tiro Afeta), Southwest Ethiopia. These districts are located in the Gilgel Gibe catchments of southwest Ethiopia (Figure 1).The climate of the Gilgel Gibe catchment is characterized as hot humid tropical with bimodal heavy rainfall which is uniform in amount and distribution, ranging from 1200 to 2800 mm per year, with short and main seasons occurring from mid February to May and June to September, respectively [10]. In normal years, the rainy season extends from mid February to early October. The mean annual temperature of the area is 19.5°C [11]. The study districts are further described in Table 1.

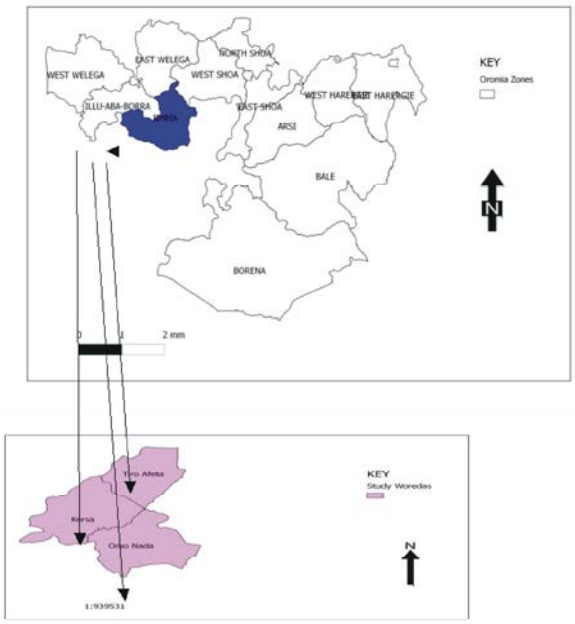


Fig. 1: Map of Oromia region, Jimma zone and study districts

**Sampling Technique:** The three districts (Kersa,Tero Afeta and Omo Nada), in Gilgel Gibe Catchments of Jimma zone, Southwest Ethiopia were purposively selected for this particular study based on their livestock potential, representing mixed crop-livestock farming systems of southwest Ethiopia, accessibility and availability of research fund obtained through Institutional university cooperation (VLIR-UOS/ IUC-JU) project during planning stage. VLIR-UOS/ IUC-JU program have a multidisciplinary project in the Gilgel Gibe catchments with the aim of investigating the impact of the Gilgel Gibe Dam. For representation of each agro-ecology, three farmers associations (FAs) from each districts representing three topographic locations (HAR: high altitude region, 2001-2800 m.a.s.l; MAR: medium altitude region MAR, 1751-2000 m.a.s.l); LAR: low altitude region and LAR, 1200-1750 m.a.s.l) were selected using stratified random sampling technique. Households (HHs) who have a minimum of 10 years experience in livestock production and have at least two species of livestock were included in the study. Accordingly, 122, 188 and 104 HHs from Kersa, Omo Nada and Tero Afeta districts, respectively and a total of 414 HHs from the three districts, were participated in the study. The selected farmers were interviewed using a structured questionnaire which was pre-tested with 18 farmers in each district.

Table 1: Description of the study areas

| | Study Districts | | |
|---|---|---|---|
| | Kersa | Omo Nada | Tiro Afeta |
| Area (S.km) | 975 | 1589.4 | 1001.9 |
| Topography | platues, hills plains,mountains, valley | dissected plateaus, mountains, plains valy | Dissected platues, mountains, valleys |
| Altitude | 1740 to 2660 m.a.s.l | 1000 to 3340 m.a.s.l | 1640 to 2800 m.a.s.l |
| Climate | 33% dega, 67% woinadega | 40% dega, 45% w/dega and 15% kolla | 85% woinadega, 15% dega |
| Soil type | Orthic Acrisols and pellic Vertislos | Pellic Vertisols and Orthic Acrisols | Chromic and pellic vertisol, orthic acrisol |
| Vegetation | high forests, Woodlands, reverie and manmade forests | High forest, woodland, riverine, shrub and manmade forests | High forest, woodland, reverine, bush and shrub and manmade forests |
| No pop. | 131,150 | 194,978 | 100,700 |
| Family size | 4.8 | 4.6 | 4.3 |
| Land use | 58.6% arable, 17.3% grazing land, 6.3% forest | 56.8% arable,25.2% grazing land, 14% forest | 26% arable, 8.3% grazing, 14% forest |
| L/ holding | 0.75 ha | 0.67 ha | 1.75 ha |
| Widely cultivated crops | *Teff*, maize, sorghum, wheat barley, horse bean, field pea and haricot bean | Maize, *teff*, sorghum, wheat, barley, horse bean, lentils and filed pea | *Teff*, maize, sorghum, barley, horse bean, field pea, wheat, *neug* and haricot bean |

Source: Government of Oromia region, 2011

The total sample size for household interview was determined using probability proportional sample size-sampling technique [12].

$$no = \frac{Z^2 * (P)(q)}{d^2} \rightarrow n_1 = \frac{no}{(1 + no/N)}$$

Where;
$n_o$ = desired sample size according to Cochran [12] when population greater than 10,000
$n_1$ = finite population correction factors [12] population less than10,000
Z = standard normal deviation (1.96 for 95% confidence level)
P = 0.1 (Proportion of population to be included in sample i.e. 10%)
q =is 1-P i.e. (0.9)
N = is total number of population
d =is degree of accuracy desired (0.05)

Discussion with 10 key informants organized from different groups was held in each study FAs for triangulation purposes and to gain an in-depth insight about the topics covered in the structured questioner for interview and to check whether patterns found in the Hhs were valid by focus groups. In general, focus group discussions using checklists that contained livestock production systems, livestock feed resources and utilization, opportunities and constraints for livestock production coupled with pretested questionnaire helped the researcher to design structured questionnaire. Finally, systematic random sampling technique was followed to select the respondent HHs.

**Data Collection:** Socio-economic data, livestock feed resources, conservation and utilization practices and livestock feeding systems in the study districts were collected.

**Socio-Economic Data:** Socio-economic data like: age, sex, marital status, educational level and family size of the respondent households, land holding and usage, sources of income, objective of livestock keeping were collected.

**Dry Matter Yield of Natural Pasture:** The total amount of DM available in natural pastures in the study area was determined by multiplying the average value of grazing land holding with the per hectare DM output of the natural pastures 2 tDM/ha/year [13]. Amount of DM obtained from communal grazing land was factored in to total communal grazing areas for each total households and their associate TLU eligible to graze on this land unit.

**Available Crop Residues and after Math Grazing:** The quantity of available crop residues (DM basis) was estimated from the total crop yields of the households,

which was obtained from questionnaire survey, according to FAO [13] conversion factor for the Ethiopian condition. Conversion factors are 1.5 for barley, wheat, *teff*, oats; 2 for maize, 1.2 for pulse and oil crop straws and 2.5 for sorghum. The quantity of crop residue on the basis of DM available and those actually available for livestock consumption was estimated by deducting 10% as wastage [14]. Quantities of available DM in aftermath grazing was determined by multiplying the available land by the conversion factor of 0.5 [13].

**Estimation of the Balance Between DM Supply and Requirement for Livestock:** Total available DM's in the main rainy season from natural pasture, crop residues, crop aftermath were compared to the annual DM requirements of the livestock population in the sampled households. Data of livestock population in the sample households was obtained from the interview of HH heads during the survey. To compare, the number of livestock population was converted into tropical livestock units (TLU) using the conversion factors of Gryseels and Anderson [15], ILCA [16] and FAO [17]. The DM requirements of the livestock population were calculated according to the daily DM requirements for maintenance of 1 TLU [18].

In this study neither poultry feed availability assessment nor poultry feed requirement were included due to shortage of time and required budget for the data enumerators and the researcher, as well as lack of TLU conversion factors.

**Statistical Analysis:** Both qualitative and quantitative data were cleaned and entered into Microsoft office Excel 2007 sheet every day after administering questionnaire to prevent loss of data. All the surveyed data were analyzed using Minitab Statistical Software [19] version 16.1. Statistical variations for qualitative variables (Frequencies and percentages) were tested by means of cross tabs, with significant differences at $P \leq 0.05$. Mean comparisons were carried out using Chi-square test for the qualitative variables. The descriptive statistics for the quantitative variables were subjected to one way analysis of variance (One-way ANOVA) using the general linear model procedure of Minitab. Mean comparisons were carried out using Tukey test for the quantitative variables. Levels of significance also considered at $P \leq 0.05$. Analyzed data were presented using tables, figures, percentages, means and standard errors. The appropriate statistical model used for assessment of feed resources and utilization systems:

$$Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

Where, $y_{ij}$ = the response of the $j^{th}$ HH in the $i^{th}$ location
$\mu$ = overall mean
$\alpha_i$ = effect of $i^{th}$ location (i = 3)
$\varepsilon_{ij}$ = random error

## RESULTS AND DISCUSSIONS

**Livestock Production System:** Like other highland parts of Ethiopia livestock production systems in the current study districts was also mixed-crop livestock production system and exists in all over the districts throughout the year. Therefore, throughout this document the livestock production system is referred as mixed-crop livestock production system for ease of presentation.

**Socio-Economic Characteristics of the Respondents**

**Households Characteristics:** Sex of HH heads, age, educational status and family size are presented in (Table 2). Out of the overall responded household heads, 94.04% of them were males. Teshager *et al.* [20] reported male dominated HH heads (95.6%) in Ilu Aba Bora zone, Southwest, Ethiopia. According to Workneh Ayalew and Rowlands [21] about 96% of households in Oromia region are male headed. The result of the current study is higher than Yeshitila [22] who reported 91.3% male headed HHs in Alaba district of Southern Ethiopia.

There was a significant difference ($P < 0.05$) in age of the respondents in the study districts and the overall mean age was 45.32±0.88 years. The highest mean age was found in Omo Nada (47.34±0.95 years) followed by Tiro Afeta (45.77±0.84 years ) and the lowest mean age was found in Kersa (42.86±0.85 years) districts, respectively. The current study is in agreement with the report of Adebabay [23] who reported 45.08 years in Bure district of northern Ethiopia.

The current finding is higher than the study of Tesfaye [24] who has reported overall average age of 41.2 years in Metema district, Northern Ethiopia. However it is lower than Zewdie [25] who reported mean age of 47±1.7 years in Highlands and Central Rift Valley of Ethiopia.

There was a significant difference ($P<0.05$) in the educational status of the study HHs and the overall educational status of the respondent depicts (Avg., 80%) illiteracy. Accordingly, the highest level of illiteracy was recorded in Kersa (82.22%) followed by Tiro Afeta (80%) and the lowest level of illiteracy were observed in Omo Nada (71.11%). Similar finding was reported by Yisehak *et al.* [7] in three districts of Jimma zone,

Southwest Ethiopia. The current finding is higher than the finding of Yeshitila [22] who has reported 58.5% illiterate HHs in Alaba district Southern Ethiopia. Teshager *et al.* [20] reported 11.7% illiterate HHs in Ilu Aba Bora zone of Southwest Ethiopia. Since education is an important tool to bring fast and sustainable development and had roles in affecting household income, adopting technologies, health and the whole socio-economic status of the family this low educational level might had a negative impact to adopt technologies in the study areas. The low level of education in the studied households has an influence on the transfer of agricultural technologies and their participation in development [26].

Family size of the household was not significantly different (P>0.05). The overall mean family size in the studied HHs was 8.34±0.41. The result of the current study is in agreement with the finding of Yeshitila [22] who reported 8.52±0.41 in Alaba district of Southern, Ethiopia. However, the current finding is higher than the average family size reported by Teshager *et al.* [20], CSA [27] and Kedija [28] who reported mean family size of 5.0, 6.62±0.22 and 7.09±0.15 in Oromia region, Mieso district and Ilu Aba Bora zone of Oromia national region, respectively. The main source of labor in the sampled HHs is their family.

**Land Holding and its Allocation:** Land holding and utilization of the study areas are presented in Table 3. There was no significant difference (*P*>0.05) in total land holding in the study districts. The overall average land holdings per household was 2.14±0.06 ha. The total land holding in the current study is in agreement with the finding of Yisehak *et al.* [7] in Jimma zone of Southwest Ethiopia. The total land holdings in the current study areas were greater than the finding of Shitahun [29] and Belete [30] whose reported 1.55 ha and 1.93 ha in Bure district of Amhara National Region and Goma district of Jimma zone, Oromia National region, respectively. Also, it's greater than the national average land holding of 1.2 ha [27]. In all the study districts discussion with key informants revealed that land holding per HHs were decreasing in the last three decades. This is because land holding is fixed whereas successive new families to be formed due to population growth share only what was previously owned by their families leaving some plots to their families.

Farmers in the studied districts allocate larger proportion of their land for crop production than grazing land which agrees with the finding of Teshager, Belay *et al*. [20] in Ilu Aba Bora zone of Southwest Ethiopia. In the current study out of the total land,

Table 2: Household characteristics of the respondents in the study areas

| | | Districts, mean (±SEM) | | | | |
|---|---|---|---|---|---|---|
| Characteristic | | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Age of respondents | | 42.86±0.85[b] | 47.34±0.95[a] | 45.78±0.84[a] | 45.32±0.88 | * |
| Family size | | 8.48±0.41 | 7.92±0.32 | 8.6±0.5 | 8.34±0.41 | ns |
| | | Districts, % of respondents | | | | |
| Sex of the HH | Male | 91.11 | 94.44 | 96.67 | 94.07 | ns |
| | Female | 8.89 | 5.56 | 3.33 | 5.93 | |
| Number of wives ofMale HH | 1 | 87.78 | 90.00 | 82.22 | 86.67 | ns |
| | 2 | 10.00 | 5.56 | 13.33 | 9.63 | ns |
| | 3 | 2.22 | 4.44 | 4.44 | 3.70 | ns |
| Educational status of the HH head | Literate | 17.78[b] | 28.89[a] | 20.00[ab] | 20.00 | * |
| | Illiterate | 82.22[a] | 71.11[b] | 80.00[ab] | 80.00 | * |

Means in the same row for each parameter with different superscripts are significantly different (p <0.05); *p<0.05; ns: non-significant difference (p>0.05); SEM: standard error of mean

Table 3: Mean ± SEM landholding (ha) per HHs and land use in the study areas

| | Districts, (Mean ± SEM) | | | | |
|---|---|---|---|---|---|
| Land holding | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Grazing (pastureland) | 0.23±0.04 | 0.15±0.03 | 0.20±0.04 | 0.19±0.34 | ns |
| Crop land (arable) | 1.96±0.11 | 1.96±1.10 | 1.91±0.10 | 1.94±0.01 | ns |
| Total land | 2.19±0.12 | 2.11±0.12 | 2.11±0.11 | 2.13±0.06 | ns |

*SEM: standard error of means*

only 0.19±0.34 ha (8.92%) was allocated for grazing in all the study districts. This finding is higher than the study of Shitahun [29] who reported 0.04±0.01 ha (3.14%) grazing land per household in Bure districts of Amhara region.

**Sources of Income in the Studied Households:** In the current study both crop and livestock productions were the major sources of HHs income (Figure 2). From all the surveyed HHs, 84.07% of them revealed that their major sources of income were both crop and livestock sale followed by crop sale (7.78%) and livestock and its products (6.67%) and the rest was from agricultural and non-agricultural employments. The current finding is in agreement with Duguma *et al*. [20] who reported (72.8%) HHs income from both crop and livestock in Ilu Aba Bora zone of Southwest Ethiopia and Yisehak *et al*. [7] in Jimma zone of Southwest Ethiopia. According to the results of the study, livestock production has multiple contributions for a source of income and survival of the studied households. Poorer households supplement their annual cash income through local agricultural labor employment (Weeding and harvesting) on the fields of middle and better-off households and also participate in sale of charcoal and firewood.

**Assessments of Feed Resources and Feed Utilization:** The major sources of feed for livestock in the study areas were natural pasture and roadside grazing, stubble grazing/crop aftermath, crop residue, wild browse/fodder trees and shrubs, crop thinning and non conventional feeds like *chat* (*Catha edulis*) leftover and household leftover (Figure 3). Accordingly natural pasture and crop residues including aftermath grazing were the major feed resources for livestock feeding in the studied areas which agree with the reports of Tolera *et al*.[4], Yisehak *et al*. [7] and Dawit *et al*. [31] whose reported natural pasture and crop residue to be the major feed resources for highlands of Ethiopia.

**Natural Pasture:** There were private and communal grazing lands in all the studied districts. According to 50% of the respondents across the study districts, the primary feed to animals came from natural pasture which conforms to the general indication that natural pasture is one of the major sources of animal feed [7, 20, 32]. Of the sampled households, 45.56%, 53.33% and 51.11% in kersa, Omo Nada and Tiro Afeta districts respectively have ranked natural pasture as the primary source of feed (Figure 4).

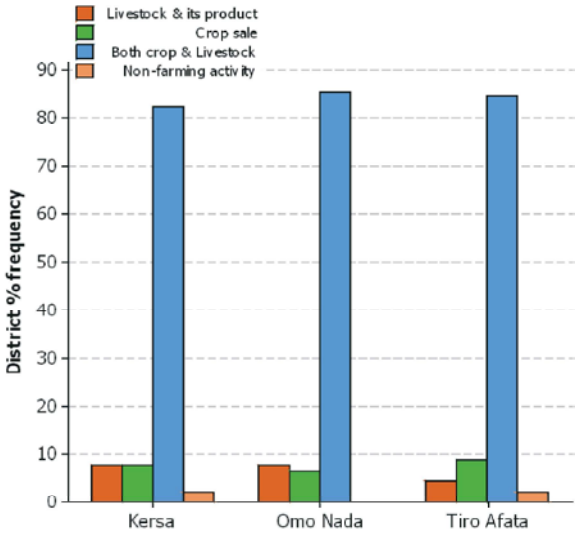


Fig. 2: The main sources of income of the surveyed households in the study areas

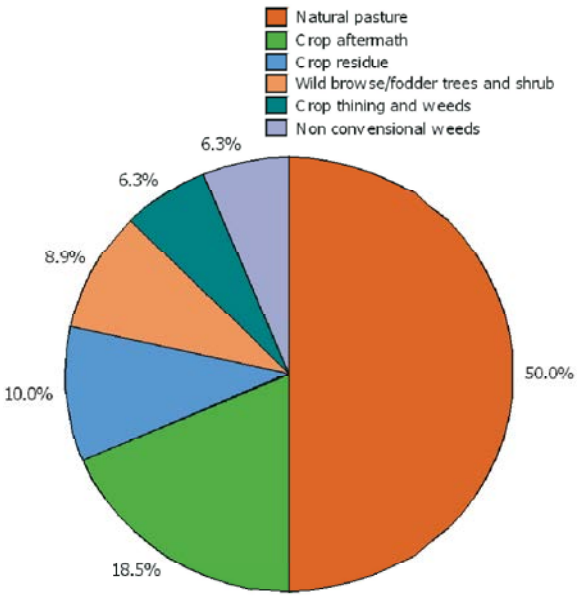


Fig. 3: Major livestock feed resources in the study areas

Browse species are commonly used in the diets of ruminants [33]. According to the same authors *Pennesetum clandestinum, Cynodon dactylon, Digiteria spp, Eragrostis spp, Sporobolus spp, Brachiaria spp, Phalaris spp, Hyparrhenia spp, Eleusine spp* and *Andropogon spp* are the most common grass species of the study area.

**Dry Matter Production from Private Grazing Land:** There were no significant difference in private grazing land holding and DM produced from private grazing land in the study districts. The overall mean DM produced from

Table 4: Mean DM production from PGL and CGL per HH across the study districts

| | Districts, (Mean ± SEM) | | | | |
|---|---|---|---|---|---|
| Description | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| PGL holding | 0.23±0.04 | 0.15±0.03 | 0.20±0.04 | 0.19±0.04 | ns |
| DM production PGL | 0.46±0.08 | 0.30±0.06 | 0.40±0.08 | 0.38±0.08 | ns |
| CGL | 0.1±0.03 | 0.2±0.02 | 0.1±0.04 | 0.13±0.03 | ns |

*SEM: standard error of means; DM: dry matter; PGL: private grazing land; CGL: communal grazing land; ns, non-significant difference*

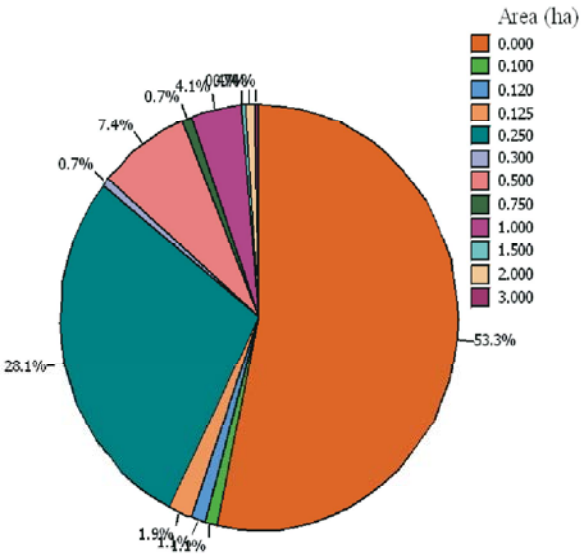


Fig. 4: Percent of respondents having private grazing land in the study areas

private grazing land was 0.38±0.18 tons/year from an average private grazing land holdings of 0.19±0.34 hectares according to yield estimate of FAO [13] (Table 4). This finding is lower than the finding of Yeshitila [22] who reported average DM production of 1.22±0.09 tons from an average grazing land holding of 0.44±0.04 ha in Alaba district. The average livestock holding per HH in the study districts was 5.10±0.32 TLU so the annual DM requirement per HH for maintenance was 11.63±0.73 tons according to the daily DM requirements for maintenance of 1 TLU [28]. Hence the value of DM obtained from private grazing land in this study implies private grazing land is not the only sources of feed for the livestock. Additionally out of all the surveyed HHs only 47.7% have had private grazing land and the rest 53.3% relies on communal grazing land and other feed sources (Figure 4). This finding is in agreement with Shitahun [29] who reported annual DM produced from private grazing land was about 0.12 tDM per HH in which only 55.56% of the respondents do not have private grazing land.

Private grazing land holding ranges from 0 to 3 ha in which majority of the HHs leave only small piece of land for the average livestock holding discussed earlier. The fact that the households have few land allocated for grazing and less tradition of providing supplementation for their animals resulted in very low productivity of livestock. Moreover, discussion with key informants revealed that DM production from this private grazing land was successively decreasing from time to time due to lack of management.

**Dry Matter Production from Communal Grazing Land:** There was no significant difference in the amount of DM produced from communal grazing lands in all the study districts (Table 4).

Accordingly amount of DM obtained from communal grazing land and factored for each total households associate TLU eligible to graze on this land were 0.1±0.03, 0.2±0.02 and 0.1±0.04 tons/year in Kersa, Omo Nada and Tiro Afeta districts respectively. The overall mean DM produced from communal grazing land in the study areas was 0.13±0.03 tons/year. The current finding is higher than Yeshitila [22] who reported 0.06±0.18 tons of DM from private grazing land in Alaba district of Southern Ethiopia. Moreover, discussion with key informants revealed that communal grazing land is successively decreasing due to increasing human population and allocation of the available land for the newly formed house hold families by local leaders. Also DM production from the available communal grazing land is very low due to overgrazing of the limited land by large livestock population which results in land degradation and soil erosion.

**Conservation and Utilization of Natural Pasture:** In the current study, only 31.85% of the respondents conserved natural pasture and the rest of the respondents do not practiced pasture conservation at all (Table 5). Out of those practiced the conservation (93.33%) of them conserves in the form of standing hay and only 6.77% practiced hay making. There was no silage making in all

Table 5: Practice of pasture conservation and utilization in the study areas

| Conservation and utilization methods | | Districts, % of respondents | | | | |
|---|---|---|---|---|---|---|
| | | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Practice of pasture conservation | Exists | 25.56[b] | 33.33[a] | 36.67[a] | 31.85 | * |
| | Not exists | 74.44[a] | 66.67[b] | 63.33[b] | 68.15 | * |
| Form of pasture conservation | Hay making | 7.78 | 6.67 | 5.56 | 6.67 | ns |
| | Standing hay | 92.22 | 93.33 | 94.44 | 93.33 | ns |
| | Silage | 0.00 | 0.00 | 0.00 | 0.00 | ns |
| Season of conserved pasture utilization | Dry season | 96.67 | 97.78 | 94.44 | 96.30 | ns |
| | Wet season | 3.33 | 2.22 | 5.56 | 3.70 | ns |
| Types of animals get accesses to conserved pasture | Lactating and fattening | 87.78 | 84.44 | 81.11 | 84.44 | ns |
| | Draft | 7.78[c] | 11.11[b] | 15.56[a] | 11.48 | * |
| | All kind of animals | 4.44 | 4.44 | 3.33 | 4.07 | ns |
| Common grazing practiceFree/continuous grazing | | 93.33 | 95.56 | 93.33 | 94.07 | ns |
| | Controlled grazing/tethering | 6.67 | 4.44 | 6.67 | 5.93 | ns |

*Different superscripts in a row indicate statistically significant difference between the districts (P<0.05); ns, non-significant difference (P>0.05); *P<0.05*

the studied districts which may be due to lack of awareness mainly linked with inadequate extension services. Majority of the respondents (96.30%) utilize conserved pasture in dry season. Types of animals get accesses to conserved pasture were lactating and fattening (84.44%), draft animals (11.48%) and all kinds of animals (4.07%). According to 94.07%, the responded HHs free/continuous grazing was the common natural pasture feeding system practiced in the study areas.

**Causes of Grazing Land Deterioration:** The respondents described different opinion for the cause of reduced grazing land productivity. Soil erosion (65.93%) and overgrazing (21.11%) were the most common causes of grazing land deteriorates throughout the districts (Figure 5). According to the discussion with key informants livestock and human population pressure contributed to the current degradation of the grazing land in the studied districts. Accordingly expansion of arable land to satisfy the increasing demands of grain crop for the increasing human population; overstocking of livestock on a limited communal grazing land and trees/bush clearing for construction and fuel were major causes. Poor knowledge of the farmers on improved management of the grazing land was also another factor according to the discussion with the key informant from all districts.

**Impact of Grazing Land Degradation on Livestock Output:** The major consequences of grazing land degradation in all the studied districts were; poor body condition (55.19%), poor production (30.37%) and increased mortality of adult and young animals (7.04%) which results in low output from the livestock sector in the study districts (Figure 6).

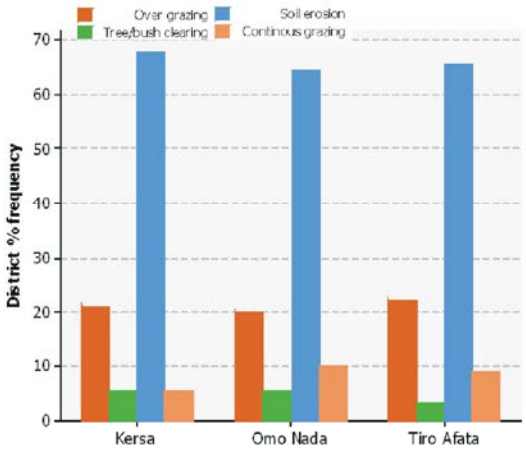


Fig. 5: Percentage of respondents indicating various causes of grazing land degradation in the study areas

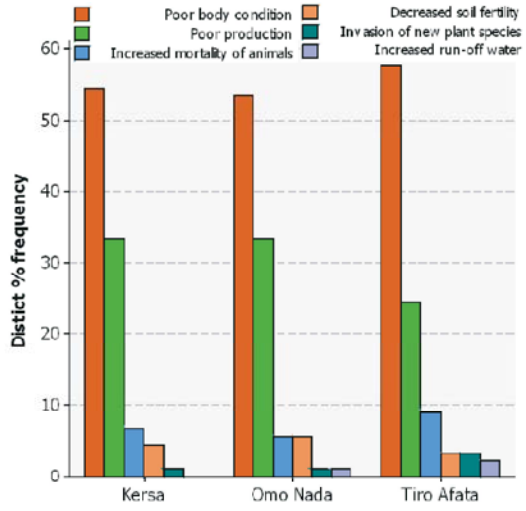


Fig. 6: Impact of grazing land degradation on livestock output across the study area

Table 6: Mean DM produced from Crop-residues and stubble grazing per household across the study areas

| | Districts, (Means ± SEM) | | | | |
|---|---|---|---|---|---|
| Types of crop | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Maize | 1.56±0.24[b] | 1.61±0.17[b] | 3.06±0.46[a] | 2.08±0.29 | ** |
| Teff | 0.32±0.05[b] | 0.32±0.03[b] | 0.69±0.12[a] | 0.44±0.07 | ** |
| Sorghum | 0.36±0.11[b] | 0.70±0.15[ab] | 0.89±0.11[a] | 0.65±0.12 | * |
| Godare (Taro) | 0.41±0.18[a] | - | - | 0.14±0.06 | * |
| Total CR | 2.69±0.60[b] | 2.63±0.35[b] | 4.76±0.76[a] | 3.35±0.59 | * |
| Utilizable CR | 2.42±0.5[b] | 2.37±0.32[b] | 4.28±0.68[a] | 3.02±0.53 | * |
| Aftermath | 0.98±0.06 | 0.98±0.05 | 0.96±0.05 | 0.97±0.06 | ns |

Different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); ns, non-significant difference ($P>0.05$); *$P<0.05$; CR: crop residue; Utilizable CR= 90% of total CR; SEM: standard errors of means

## Crop Residue

**Crop Residue Production:** Crop residues were the second feed resources for livestock followed by wild browse/fodder trees and shrubs, crop thinning and weeds and non conventional feeds including household leftover in all the study districts. However the total amount as well as the type of crop residue varied among the districts. Accordingly the major annual crops grown by farmers in the studied districts were: maize, sorghum, *teff* in all the studied districts and Taro (*Godere*) in Kersa district (Table 6). From all the types of crop residues maize and sorghum residues were the main crop residues produced in all the studied districts. This finding is in agreement with Teshager Ayalew *et al.* [20] who reported maize and sorghum residues are the main crop residues produced in Ilu Abba Bora zone of Southwest Ethiopia. Similarly, Kurtu [34] has also indicated that sorghum and maize are the major crops, providing stable food to people and various forms of feed and by products to livestock in Harari region. There were a significant difference in the total amount of residues produced in the studied districts ($p<0.05$). Accordingly, more of the crop residue or 4.76±0.76 tons was produced in Tiro Afeta district followed by 2.69±0.60 tons in Kersa district and the least 2.63±0.35 tons of crop residues was produced in Omo Nada district. Generally the overall mean crop residues produced in the study areas was 3.35±0.59 tons of DM/year and this finding is lower than Dawit *et al.* [31] who reported 9.7±0.6 tons of crop residues in Adami Tulu Jiddo Kombolcha district of Oromia region. This differences may be attributed to the area of crop land, soil fertility, types of crop grown and crop management.

**Conservation; Alternative Uses and Utilization of Crop Residues:** According to 92.96% of the surveyed HHs in all the study districts, balling under shade was the main crop residue conservation method for dry period use (Table 8). According to the respondents after harvesting of the grains residues of maize, sorghum and *teff* were collected and stored under temporary shades constructed for this purpose. The rest 7.04% of the respondents stack/bale outside mainly on the field or around homestead without any shading.

Farmers in the current study areas uses crop residues as bedding material in livestock barns, as mulching/organic fertilizer by leaving on the field and as source of fuel (Table 7). From all the surveyed households (80.37%) of the respondents leave crop residues on the field as organic fertilizer for the next crop calendar. The rest of the respondents (12.59%) and (7.04%) uses crop residues as source of fuel and as bedding material in livestock barns, respectively. On the other hands discussion with key informants and surveyed households revealed that farmers in the study areas can also use *teff* straw as a construction material for plastering walls of leaving home. According to Yeshitila [22] crop residues are alternatively used for fuel by 71% of the households, as roof shatter by 9.5%, as fences by 8.5% and a combination of all the three by 10% of the surveyed households in Alaba district of Southern Ethiopia. Similarly, according to Tolera *et al.* [4] 10% of crop residues produced in the highlands of Ethiopia are considered as wastage or use for other purposes like for construction or as fuel. Accordingly, from all crop residues produced in the current study districts only 2.42±0.5, 2.37±0.32 and 4.28±0.68 tons of DM/HH/annum were utilized as livestock feeds in Kersa, Omo Nada and Tiro Afeta districts, respectively. The overall mean DM of crop residues annually utilized per HH in the study areas was 3.02±0.53 tons.

Lactating animals (85.56%), draft animals (8.15%) and fattening animals and all kinds of animals (2.59%) were the prioritized animals in gating access to the conserved crop residues.

Feeding of crop residues as it is under shade or on the field without any physical or chemical treatments were commonly practiced in all the study districts.

Accordingly, 95.56% of the respondents fed as it is under shade or on the field which implies no quality improvement and treatment of this poor quality crop residue for better animal performance. The rest (4.44%) of the respondents chopped to decrease the size and increase palatability.

Practices of supplementing animals offered crop residues in the current study areas revealed that (84.44%) of the respondents supplement their animals by household leftover followed green forage and grain mill shorts by (6.3%) of the respondents and the rest (2.29%) of the respondents supplement by cereal grains.

The organic matter digestibility of crop-residues ranges from 40-50% [35]. Because roughages have low digestibility and low protein content during most of the year, (Without feed supplement and/or proper treatment method) the roughage feed supplies can at most meet maintenance requirement resulting in slow growth, poor fertility and high calf mortality. Crop residues are very important feed resources in smallholder systems, but they are generally inadequate feed materials, thus their use at the proper treatment methods and with supplements needs consideration [36]. In the study areas, feed supplement and straw treatment were not yet well practiced. As a result, even if huge amount of crop-residue was produced, especially during the dry season animals may not get the required nutrient to the level they could produce as per their genetic potential.

**Stubble Grazing/Crop Aftermath:** Crop stubble is one of the important feed sources in the studied districts. Accordingly farmers in the studied districts have also categorized aftermath grazing in the third place as animal feed (Figure 3). After harvesting the crops, livestock are allowed to graze stubble of different crops (Maize, *teff*, sorghum, etc) mainly from October to November depending on the type of crop and time of harvest. There was no significant difference in the amount of stubble grazing in the studied districts and the overall mean stubble grazing produced per HH was 0.97±0.06 tons of dry matter. The current result is lower than the finding of Shitahun [29] who has reported 1.14 ±0.05 tons of stubble grazing per household in Bure district of Amhara region. Yeshitila [22] also reported 1.34±0.71 tons of stubble grazing per household in Alaba district of Southern Ethiopia. This difference may be attributed to the area of cultivated land since dry matter yield from aftermath is mainly dependent on area of crop land.

Table 7: Alternative uses of crop residues across the study areas

| | Districts, % of respondents | | | | |
|---|---|---|---|---|---|
| Alternative uses | Kersa | Omo Nada | Tiro Afata | Overall | P |
| 1 | 6.67 | 6.67 | 7.78 | 7.04 | ns |
| 2 | 86.67$^{a}$ | 85.56$^{a}$ | 68.89$^{b}$ | 80.37 | * |
| 3 | 6.67$^{b}$ | 7.78$^{b}$ | 23.33$^{a}$ | 12.59 | * |

Different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); *P<0.05;ns non significant: 1= use as bedding material in livestock barns; 2=mulching/organic fertilizer;3=source of fuel

Table 8: Conservation and utilization methods of crop residue in the study districts

| | | Districts, % of respondent | | | | |
|---|---|---|---|---|---|---|
| Parameters | | Kersa Omo | NadaTiro | Afeta | Overall | P |
| Method of storing crop residues | Baling under shade | 91.11 | 93.33 | 94.44 | 92.96 | ns |
| | Stacked/baled outside | 8.89 | 6.67 | 5.56 | 7.04 | ns |
| Form of crop residue to be fed | Fed as it is | 93.33 | 95.56 | 97.78 | 95.56` | ns |
| | Copped | 6.67 | 4.44 | 2.22 | 4.44 | ns |
| Animals fed crop residue (ranking order) | Lactating animals | 88.89$^{a}$ | 88.89$^{a}$ | 78.89$^{b}$ | 85.56 | * |
| | Draft animals | 4.44$^{b}$ | 7.78$^{b}$ | 12.22$^{a}$ | 8.15 | * |
| | Fattening animals | 2.22 | 1.11 | 4.44 | 2.59 | ns |
| | Dry animals | 2.22 | 0.00 | 1.11 | 1.11 | ns |
| | All kind | 2.22 | 2.22 | 3.33 | 2.59 | ns |
| Practices of supplementing animals offered crop residues, what it if? | Household leftover | 90.00$^{a}$ | 85.56$^{ab}$ | 77.78$^{b}$ | 84.44 | * |
| | Green forage | 4.44$^{b}$ | 3.33$^{b}$ | 11.11$^{a}$ | 6.30 | * |
| | Grain mill shorts | 4.44 | 5.56 | 8.8 | 6.30 | ns |
| | Cereal grains | 1.11 | 5.56 | 2.22 | 2.29 | ns |

Different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); *P<0.05;ns non significant

Table 9: Practice of integrating fodder tree/shrubs in to farming system in the studied HH

| | Districts, % of respondent | | | | |
|---|---|---|---|---|---|
| Available Practice | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Present but very low | 34.44 | 30.00 | 43.33a | 35.93 | ns |
| Absent | 65.56 | 70.00 | 56.67 | 64.07 | ns |

ns: non- significant difference

Table 10: Reason for not using agro-industrial by products as livestock feed

| | Districts, % of respondent | | | | |
|---|---|---|---|---|---|
| Reasons | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| High cost | 87.78 | 91.11 | 85.56 | 88.15 | ns |
| Produce in very far area | 7.78 | 3.33 | 6.67 | 5.93 | ns |
| Lack of awareness | 4.44 | 5.56 | 7.78 | 5.93 | ns |

ns: non-significant difference

According to the discussion with key informants farmers in the studied districts use aftermath grazing as one means to sustain their livestock for duration of about 3-4 months starting from October until January. Therefore, stubble grazing is one of the ways by which livestock keepers in the studied districts greatly depend on.

**Wild Browse/Fodder Trees and Shrubs:** According to 8.89% of the respondents wild browse/fodder trees and shrubs were also the main sources of livestock feeds mainly during the dry season (Figure 3).

It was observed that majority of the households (64.07%) did not have practice of integrating fodder trees and shrubs in to their farming system and the rest (35.93%) have had very low practice of integration (Table 9). However due to heavy crop cultivation, population pressure, over grazing and erosion hazard, have been thoroughly noticed in the studied districts which needs shift in farming system which encourages expansion of dual purpose trees and shrubs.

Syzygium guineense, Draceana studeri, Ficus ovata, Ficus vasta, Ficus sycomorus, Ficus capensis, Ficus thonningii, Salix purpurea, Arundinaria alpine, Syzygium guineense, Milletia ferruginea, Sapium ellipiticum,and Vernonia amygdalinaspecies are some of the trees and shrubs well known by farmers and highly utilized in livestock feeding [33].

However, very few farmers climb up forage trees to lop down and give it to their livestock during critical feed problems. Due to this, quantification of DM yield from these fodder trees and shrub was not possible. Fodder trees and herbaceous legumes offer an opportunity for use as potential feed supplements by smallholder farmers in the tropics due to their high CP content and degradability [37] as well as for the possibility of incorporating them in the general farming activity.

**Non Conventional Feed resources:** According to (6.3%) of respondents in all the studied districts; non conventional feed resources including households leftover were also the main livestock feeds (Figure 3). Accordingly residues of local drinks like coffee, local beverage alcolo (*areke)*, *tela* and leftover of *Chat* (*Catht edulus*), fruits and vegetable refusals and households food leftovers were mainly used as livestock feeds. However it was not possible to get a clear data of these non conventional feed resources utilization to quantify its DM contribution, but one can assume this will increase the total dry matter of feed used in the studied households.

**Agro-Industrial by-Products:** In the current study none of the household use agro-industrial by products as a potential concentrates for livestock feeds (Table 10). According to 88.15% of the respondent households, high cost for agro-industrial by-products was one of the main limiting factors not to use as livestock feeds. On the other hand lack of awareness on use of agro-industrial by products as livestock feed was also mentioned by 5.93% of the surveyed households. The rest 5.93% of the households described all agro-industrial by-products are produce in very far area.

**Annual Utilizable DM Supply from Different Feed Source in the Studied HHs:** The total annual DM production and contribution of available feed resources in the studied households were shown in Table 11.

Table 11: Amount and percent contribution of different feed sources to the total DM supply per HH

| | Study Districts | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kersa | | Omo Nada | | Tiro Afeta | | Overall | | |
| Feed sources | tDM | % | tDM | % | tDM | % | tDM | % | p |
| PGL | 0.46 | 11.5 | 0.3 | 7.8 | 0.4 | 6.9 | 0.39 | 8.6 | ns |
| CGL | 0.1 | 2.5 | 0.2 | 5.1 | 0.1 | 1.7 | 0.13 | 2.9 | ns |
| UCR | 2.46[b] | 61.5 | 2.37[b] | 61.6 | 4.28[a] | 74.6 | 3.04 | 67.1 | * |
| SG | 0.98 | 24.5 | 0.98 | 25.5 | 0.96 | 16.8 | 0.97 | 21.4 | ns |
| Total supply | 4[b] | 100 | 3.85[b] | 100 | 5.74[a] | 100 | 4.53 | 100 | * |

Different superscripts in a row indicate statistically significant difference (P<0.05); ns, non-significant difference (P>0.05); *P<0.05; PGL: Private Grazing Land; CGL: Communal Grazing Land; UCR: Utilizable Crop Residue= crop residue (90%); SG: Stubble Grazing; TDM: Tons Dry Matter

Table 12: Annual maintenance requirement vs annual utilizable DM supply in the study areas

| | Study Districts | | | | |
|---|---|---|---|---|---|
| Variables | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Annual utilizable feed supply (tDM) | 4[b] | 3.85[b] | 5.74[a] | 4.53 | * |
| Annual Maintenance Requirement (tDM) | 10.31b | 10.93[b] | 13.09[a] | 11.44 | * |
| Balance (supply - requirement) (tDM) | -6.31 | -7.08 | -7.35 | -6.91 | ns |
| Supply from the requirement (%) | 38.79[b] | 35.22[c] | 43.85[a] | 39.59 | * |

Different superscripts in a row indicate statistically significant difference between the districts (p<0.05); *P<0.05; ns non significant: tDM: tons Dry Matter

In terms of annual DM production per household, the available feed resources could be arranged as crop-residue, stubble grazing, private grazing land and communal grazing land in a decreasing order of sequence.

Proportions and shares of the feed resources in the studied districts showed that, from total utilizable DM production the contribution of cropping system was 88.5% per household which comprised 67.1% crop-residues and 21.4% stubble grazing. This finding is in agreement with Shitahun [29] who reported 84.81% in Bure district of Amhara region, but it's higher than the finding of Solomon [38] who reported 74.5% in Sinana sub-district of Bale highland. This may be due to a shift in land use from grazing land to crop production to satisfy the increasing food demand as a result of increasing population pressure. However, DM production from cropping system varies between the studied districts ($P$<0.05). Accordingly the highest DM produced from crop residue was observed in Tiro Afeta (4.28 tons) followed by Kersa (2.46 tons) and Omo Nada (2.37 tons).

The contribution of natural pasture as feed source only accounted for about 11.5% in which private grazing land accounted 8.6% and communal grazing land accounted 2.9%. This finding is in agreement with Shitahun [29] who reported 13% but lower than Solomon [38] who reported 25.85% in Bure district of Amhara region and Sinana sub-district of Bale highland, respectively.

**Estimation of Annual Feed Balance:** The overall mean annual utilizable feed production per studied households was 4.53 tDM and the overall mean annual maintenance DM requirement according to Kearl [18] was 11.44 tDM (Table 12).

Hence the annual utilizable feed dry matter satisfied only 39.59% of the livestock maintenance requirement of the studied HHs which is quite far below the requirements. This is quite low and clearly shows the gap that exists between feed balance and livestock number at any rate and it is incomparable with many of other results. For instance, Dawit *et al*. [31] and Wondatir [39] reported 83% and 86% maintenance DM requirement coverage per farm per year in central Rift Valley and Adami Tullu district, respectively.

However in the current study not all livestock feed resources used in the studied districts were quantified, for instance non conventional feeds like households food leftovers, residues from different local drinks, *chat* leftover which was usual used by households every day, vegetables and fruits refusals and fodder trees and shrubs were not quantified due to lack of reliable data and measurement units.

**Available Feed Resources and Their Distribution over Seasons:** In all the studied districts, the availability of feed resources varied in seasons with respect to quality, quantity and type of feed. According to 93.33% of the respondents in all the studied districts natural pasture is available year long but it's not adequate. However, there was a significant difference ($P$<0.05) in the availability of hay but not crop residue by season (Table 13). In general the principal dry season feed resources available to livestock in the studied areas include crop-residue, hay and natural pasture in their descending order. Whereas, natural pasture, crop-residue and stubble grazing are wet season livestock feeds in their descending order of importance. There was no concentrate feed availability as livestock feed in all the studied districts except household leftover. According to the discussion with key informants feed scarcity is more sever in the dry season mainly from April to June until new grass grow in the long rainy season. Different feed scarcity coping mechanism was also described by farmers and key informants (Figure 7).

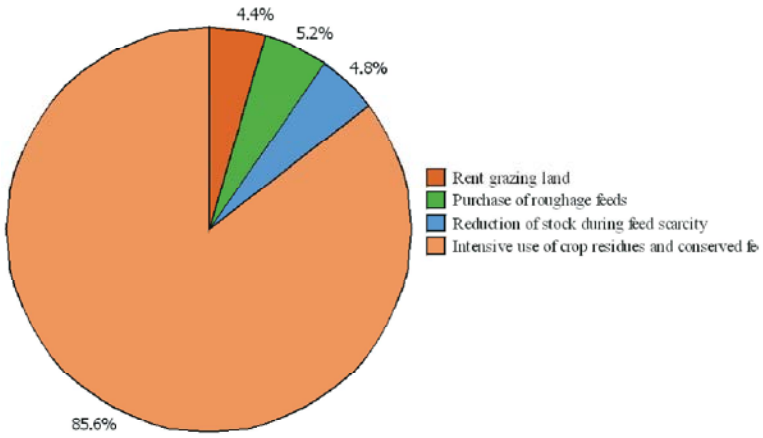


Fig. 7: Traditional feed scarcity coping mechanisms in the study areas

Table 13: Types of feed resources and their availability by season in the study areas

| | | Districts, % of respondent | | | | |
|---|---|---|---|---|---|---|
| Variables | | Kersa | Omo Nada | Tiro Afeta | Overall | P |
| Availability of roughage feed in dry season | Adequate | 7.78 | 8.89 | 10.00 | 8.89 | ns |
| | Not adequate | 92.22 | 91.11 | 90.00 | 91.11 | ns |
| Roughage feed resources in wet season | Not adequate | 100.00 | 100.00 | 100.00 | 100.00 | ns |
| Month's Natural pasture available | Mainly on rainy season | 5.56 | 5.56 | 8.89 | 6.67 | ns |
| | Year long | 94.44 | 94.44 | 91.11 | 93.33 | ns |
| Months Hay available | January to May | 1.11$^{b}$ | 2.22$^{b}$ | 7.78$^{a}$ | 3.70 | * |
| | February to May | 43.33$^{b}$ | 65.56$^{a}$ | 65.55$^{a}$ | 58.15 | * |
| | Not practiced | 55.56$^{a}$ | 32.22$^{b}$ | 26.67$^{b}$ | 38.15 | * |
| Months crop residues (stover & straw) available | December to May | 90.00 | 93.33 | 84.44 | 89.26 | ns |
| | Don't exist | 3.33 | 3.34 | 5.56 | 4.07 | ns |
| | December to March | 6.67 | 3.33 | 10.00 | 6.67 | ns |
| Months concentrate available to livestock | Nil | 100.00 | 100.00 | 100.00 | 100.00 | ns |

Different superscripts in a row indicate statistically significant difference between the districts (P<0.05); *P<0.05;ns non significant

Table 14. Feed categories per year ranked by respondent across the study areas

| | Districts, % of respondent<br>Feed categories per year ranked in order of importance | | | | | |
|---|---|---|---|---|---|---|
| Districts | 1$^{st}$ | 2$^{nd}$ | 3$^{rd}$ | 4$^{th}$ | 5$^{th}$ | 6$^{th}$ |
| Kersa | 45.56 | 16.67 | 14.44 | 11.11 | 6.67 | 5.56 |
| Omo Nada | 53.33 | 16.67 | 8.89 | 8.89 | 7.78 | 4.44 |
| Tiro Afata | 51.11 | 22.22 | 6.67 | 6.67 | 4.44 | 8.89 |
| All | 50.00 | 18.52 | 10.00 | 8.89 | 6.30 | 6.30 |

1=grazing natural pasture and road sides; 2= crop residues;3= stubble grazing/crop aftermath;4=wild browse/Fodder trees and shrubs;5=crop thinning and weeds;6= household leftover

In all the studied districts grazing natural pasture and road side, crop residues, stubble grazing, wild browse (Fodder trees and shrubs), crop thinning and weeds and household leftovers were the main livestock feed resources year round in a decreasing order of importunacy (Table 14).

**Utilization of Feed Resources:** It has been proved that the overall livestock feed produced from different sources in the current study was 4.53 tons of DM per year for a livestock unit of 5.10 TLU which shows dry matter to livestock unit ratio of 0.89 which is quite low and clearly shows the gap that exist. Moreover in addition to feed scarcity poor utilization efficiency of the available feeds in the study area was also observed. For example lack of grazing land management mainly private grazing land like, use of continuous grazing system and lack of cut and carry system was resulting in selection of more palatable species and trampling over the less palatable species.

From total DM produced in the study area 67.1% comes from utilizable crop residues. However there was utilization problem due to less attention given to storage and crop residues were excessively dumped during harvest period in addition to alternative uses of this residues. Feeding of *teff* straw at the threshing area was also observed which results in trampling, defecating and urinating.

According to the discussion with key informants *adlib* feeding of maize and sorghum Stover in the storage place was common in the study area. This feeding system may not be efficient as the Stover was trampled and refused by the cattle while they compete to get easily palatable and leafy part of the Stover when the animals are allowed to feed with free access. But it is possible to increase utilization efficiency of the Stover by offering bit by bit when the cattle utilized efficiently without trampling, urinating and defecating on the Stover in such storage condition. Additionally lack of chemical or physical treatment except chopping and soaking which is practiced by a few farmers to improve this poor quality feed source was also the main utilization problem observed in the study area. The overall themes of the present works were analogous with reports of Aschalew *et al*.[40], Getachew *et al*. [41], Malede *et al*. [42] and Afshar *et al*. [43] in that conventional feed resources were decling due to land shortage and the utilization practice to improve the feeding value of nonconventional feeds was poor.

## CONCLUSION

Natural pasture and residues from cropping system were the major livestock feed sources in all the study districts.

The mean annual DM produced was 4.52 tons/HH/year and the mean annual maintenance DM requirement was 11.44 tons/HH/year. Hence, the annual utilizable feed dry matter satisfied only 39.5% of the livestock maintenance requirement which is quite far below the requirements.

Feed shortage, diseases, low productivity, lack of training on livestock production, lack of credit service for livestock production were the major challenges of livestock production in the study areas.

So, from the current study it is possible to conclude the livestock production system of the study area as traditional mixed crop livestock production system with no uses of improved technologies.

The existing livestock feeds can no longer support the existing livestock in the study areas unless possible interventions is made by decision making bodies and channeled to the farming community through extension workers.

The feed deficit observed in the study districts could be one of the contributing factors for low productive and reproductive performance of livestock.

**Recommendations:** As obtained in the current study 53.3% of the respondent HHs do not have private grazing lands or they did not allocate land for their livestock, therefore,:- encouraging and advising livestock keepers to allocate grazing land from their total land holding is very crucial since communal grazing land is not further available due to population growth and expansion of crop farming.

There should be land use policy regulation in the area which can secure area for livestock feed production to increase the contribution of livestock sector for eradication of poverty and sustaining food security in the smallholder livestock producers as well as in the country.

To efficiently utilize the crop residues which accounted 67% of the total supply different quality improvement methods should have to be encouraged and advised to the farmers by any development organizations involving in livestock development sector in the study area.

It was noted that farmers lack awareness on the use of improved forages and hence consolidated extension service and training as well as facilitation of accessibility of improved forage with low cost is required for the farmers by agricultural development professionals.

The current study only focused on the major available feed resources in terms of type and quantity based on established conversion factor made so far by different scholars. Hence, detail study on DM production of all types of feeds used by livestock keepers as well as the chemical composition and digestibility of each feed are further required to plan sustainable livestock development strategy in the study area.

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